

Headquarters U.S. Air Force

Integrity - Service - Excellence

U.S. Department of Defense Space Weather Services



**Lt Col Mark Allen
HQ USAF/A3WX
27 April 2016**

U.S. AIR FORCE



U.S. AIR FORCE

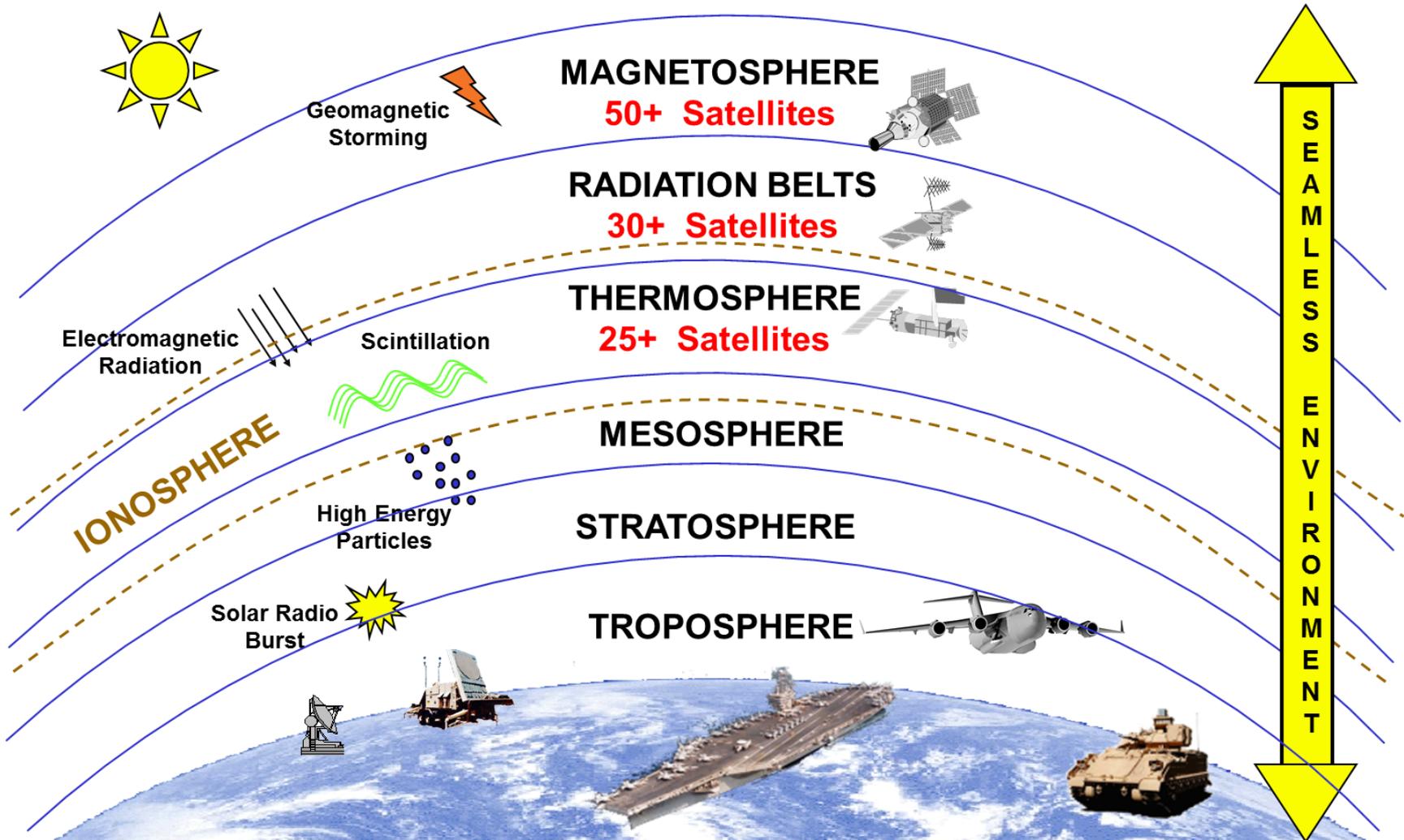
Overview

- **Space environment**
- **AF space weather observing systems – Current & Future**
 - **Ground & space-based**
 - **SECAF commitment**
- **Space weather application**
- **Space weather community**
- **DoD perspective**
- **Sensor-to-Operator chain**
- **Summary**



Space Environment

U.S. AIR FORCE

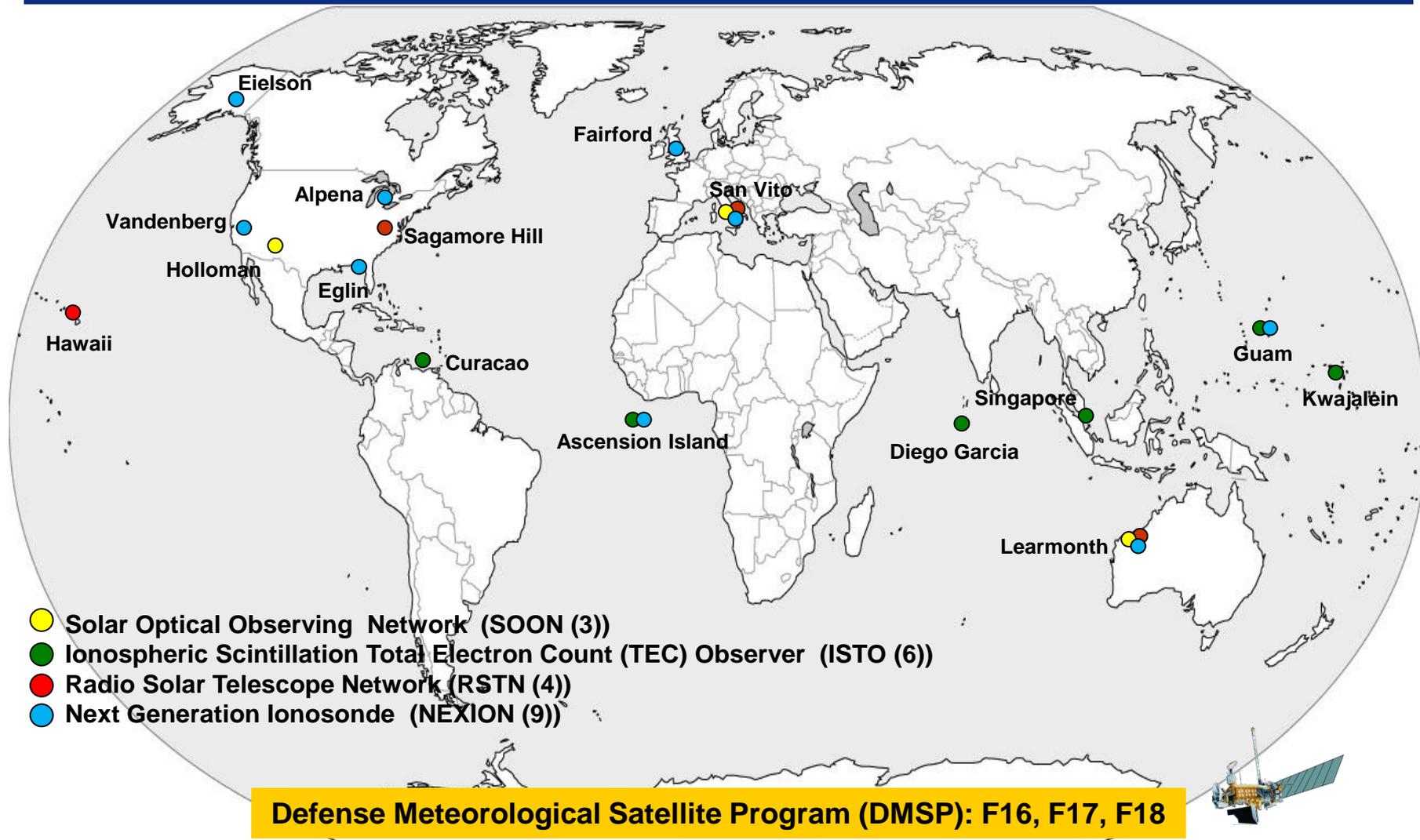


Integrity - Service - Excellence



AF Space Weather Observing Current

U.S. AIR FORCE

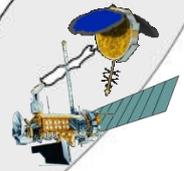
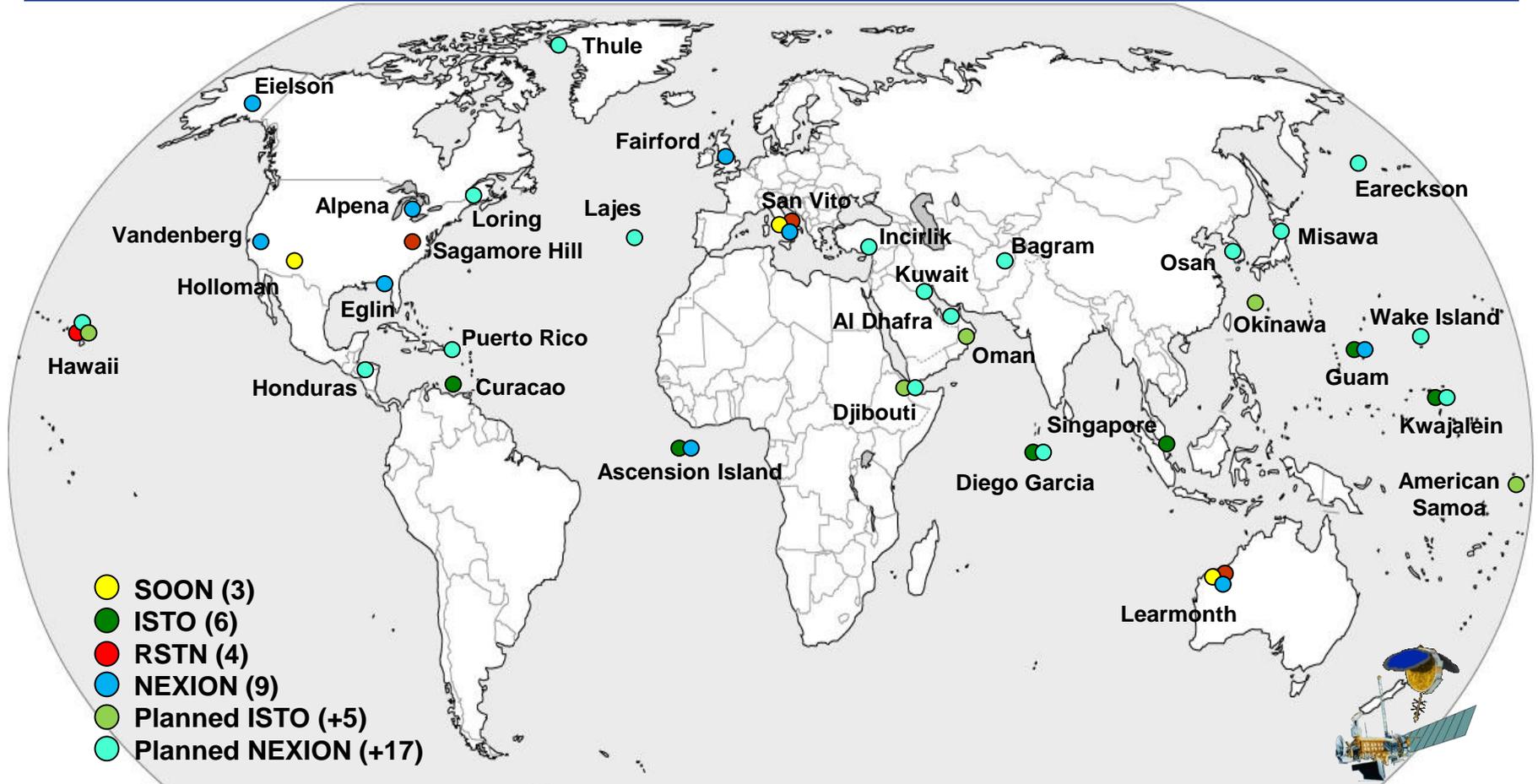


Integrity - Service - Excellence



AF Space Weather Observing Future

U.S. AIR FORCE



DMSP: F16, F17, F18

Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC)-2: Low & High Inclination
All AF Space-based Platforms (2021)

Integrity - Service - Excellence



Space-based ECP Observing

U.S. AIR FORCE

- **Energetic Charged Particles (ECP)**
 - **DoD requires specification of natural environmental conditions at the satellite**
 - **March 2015, SECAF mandated all AF satellites fly ECP sensor**
 - **AF currently working through requirements & acquisition process to field sensor**
 - **Application**
 - **SpaceWOC – Space Situational Awareness (SSA), data assimilation & modeling**
 - **JSpOC – SSA and anomaly assessment**
 - **Timeline: IOC – 2021 / FOC – TBD**



Space Weather Application

U.S. AIR FORCE

- **557th Weather Wing Space Weather Operations Center (SpaceWOC)**
 - Mission-tailored unclassified and classified analysis, forecasts, warnings
 - Disseminate system-impacting space weather
 - DoD operators and decision makers
 - National agencies
 - Anomaly assessment support
- **Joint Space Operations Center (JSpOC)**
 - C2 system executing USSTRATCOM space control mission
 - Focal point for space force integration & employment in military ops
 - Detect, track, and identify all artificial objects in Earth orbit



Mission Focused DoD & USG Operational Support



Space Weather Community

U.S. AIR FORCE

- **Space weather is a team sport!**
- **Actively engaged in global community**
- **Training**
 - **Space weather course (2 weeks) at 557 Weather Wing**
 - **Students from France, Italy, Netherlands, Germany – working to bring in Japan and South Korea**
- **Engaging with UK, South Korea on Ops Centers stand-up**
- **Data sharing via web services – national & international partners**
- **Cooperative efforts**
 - **NOAA SWPC – analysis and forecasting**
 - **AFRL, NRL, JHU/APL – modeling and data**
 - **Academic community**





U.S. AIR FORCE

Space Weather Observing for Military Operations

- What is the DoD perspective on space weather observing?
 - Operational requirement vs Research need
 - Sensor design, sustainability, lifespan
 - Assured availability
 - Sustained operational data sources
 - Dedicated communications
 - Access across all phases of military operations
 - Accredited systems
 - Usable on DoD/AF IT networks
 - Releasable to partners



Relevant, Reliable, Responsive Observations Feeding Sensor-to-Operator Chain



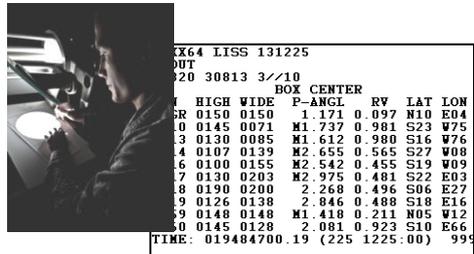
Sensor-to-Operator Examples

U.S. AIR FORCE

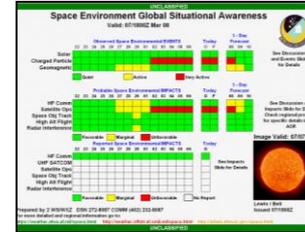
SOON – H α



Forecaster analysis & sunspot classification



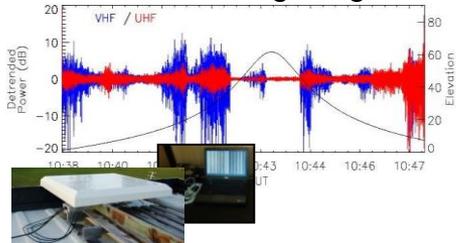
AF Space forecast space wx & impacts



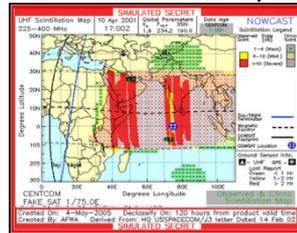
20th Space Control Sq alerted to space object tracking impacts



ISTO – Radio Frequency Beacon over flight signals



UHF Satellite Communications Scintillation Map



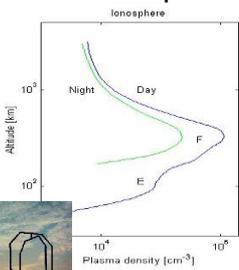
Combined Air Operations Center (CAOC) Theater Intelligence, Surveillance Reconnaissance collection



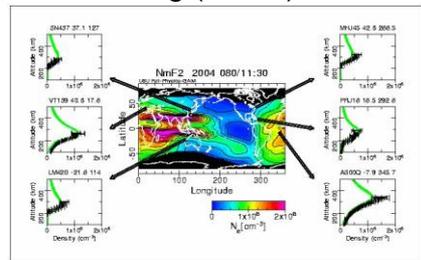
Uninterrupted RQ-1 SATCOM data link to CAOC



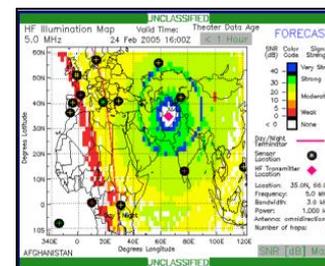
NEXION – derived profiles



Models – Global analysis, Integration, and Modeling (GAIM) assimilates obs



Impact products – HF illumination



Naval Special Warfare Rigid Hull Inflatable Boat C2 via HF Comm



SENSOR

SPACE WEATHER DATA & PRODUCTS

OPERATOR



Summary

U.S. AIR FORCE

- Air Force committed to space weather observing...now & future
- Team with national & international community for DoD Support
- Sensor-to-Operator – accurate, timely, relevant impacts delivered

Global Power



Global Reach



Air Ops



Agile Combat Support



“Air Force weather enables Joint Warfighters to anticipate and exploit the weather...for air, ground, space, cyberspace and intel operations.”

– AFW Mission



Army Ops



Global Vigilance



Special Ops



Space Weather

Integrity - Service - Excellence